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September 28, 2017

File No.: 01-773180-000

Monica Tonel
Project Manager, Office of Environmental Cleanup
U.S. Environmental Protection Agency, Region 10
1200 6th Avenue, Suite 900 MS (ECL-122)
Seattle, WA 98101
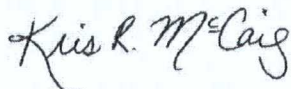
VIA ELECTRONIC MAIL ONLY

Subject: Upper Columbia River Remedial Investigation Feasibility Study – Draft Data Quality
Objectives for Determination of Background Metal and Metalloid Concentrations in
Upland Soils

Dear Monica:

On behalf of Teck American Incorporated, I am pleased to submit for your review the above-
referenced draft data quality objectives and in preparation for our upcoming meeting with the
U.S. Environmental Protection Agency (EPA) regarding the background soil assessment for the
Upper Columbia River remedial investigation and feasibility study. We look forward to our
discussion during the meeting on October 2, 2017.

Should you have any questions or require any additional information at this time, please do not
hesitate to contact me at (509) 623-4501.

Sincerely,
Teck American Incorporated

Kris R. McCaig

Kris R. McCaig
Manager, Environmental and Public Affairs

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Enclosure (1)   *Draft DQOs for Determination of Background Metal and Metalloid Concentrations in Upland Soils*

cc: Kathryn Cerise, U.S. EPA, Seattle, WA, Enclosure
       Tony Palagyi, Exponent, Bellevue, WA, Enclosure
       John Toll, Windward Environmental, Seattle, WA, Enclosure
       Dina Johnson, Ramboll Environ, Seattle, WA, Enclosure
       Dave Enos, Teck American Incorporated, Spokane, WA, Enclosure
       Cristy Kessel, Teck American Incorporated, Spokane, WA Enclosure

DQOs for Determination of Background Metal and Metalloid Concentrations in Upland Soils

Introduction

The upland soil background assessment will provide information on the range of concentrations for metals and metalloids[1] that are representative of background soils in and around the Upper Columbia River (UCR) Site (hereafter the Site[2]). This study represents one of numerous tasks to be completed as part of the remedial investigation and feasibility study (RI/FS) and baseline ecological risk assessment being conducted by Teck American Incorporated (TAI). The primary objective will be to ascertain the natural and area background soil concentrations as defined by Washington State (WAC 173-340-200[3]) and the U.S. Environmental Protection Agency (EPA; USEPA 2002[4]). This document provides the Data Quality Objectives (DQOs) applicable to determination of soil background for the Site.

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[1] The metals and metalloids assessed will include those listed in the Upper Columbia River Soil Study (TAI 2015) Table 2-1, which are aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. Thus, in this document "metals and metalloids" refers only to this list of elements.

TAI. 2015. Upper Columbia River final soil study data summary report. Prepared by Windward Environmental LLC, Seattle, WA, in association and consultation with Exponent, Bellevue, WA, Parametrix Inc., Bellevue, WA, and ENVIRON, Seattle, WA for Teck American Incorporated, Spokane, WA.

[2] The UCR Site as defined within the June 2, 2006 Settlement Agreement is the areal extent of hazardous substances contamination within the United States in or adjacent to the Upper Columbia River, including the Franklin D. Roosevelt Lake, from the U.S.-Canada border to the Grand Coulee Dam, and those areas in proximity to the contamination that are suitable and necessary for implementation of response actions.

[3] WAC 173-340-200:

"Natural background" means the concentration of hazardous substance consistently present in the environment that has not been influenced by localized human activities. For example, several metals and radionuclides naturally occur in the bedrock, sediments, and soils of Washington state due solely to the geologic processes that formed these materials and the concentration of these hazardous substances would be considered natural background. Also, low concentrations of some particularly persistent organic compounds such as polychlorinated biphenyls (PCBs) can be found in surficial soils and sediment throughout much of the state due to global distribution of these hazardous substances. These low concentrations would be considered natural background. Similarly, concentrations of various radionuclides that are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents would be considered natural background.

"Area background" means the concentrations of hazardous substances that are consistently present in the environment in the vicinity of a site which are the result of human activities unrelated to releases from that site.

[4] USEPA. 2002. Role of background in the CERCLA cleanup program. OSWER 9285.6-07P. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response and Office of Emergency and Remedial Response, Washington D.C. 13 pp.

Defines background as "constituents or locations that are not influenced by the releases from a site, and is usually described as naturally occurring or anthropogenic (EPA, 1989; EPA, 1995a):

In 2016, EPA prepared and provided TAI with a "level of effort" (LOE) memorandum that outlined an approach to compiling a background dataset from preexisting data sources along with DQO Steps 1–3 for that process (USEPA 2016[5]). In the memorandum, EPA evaluated 13 studies that may be usable in compiling a background dataset for the Site. EPA's primary criteria were that all samples should have a known location (i.e., coordinates and depth) that is near the upper Columbia River, but is outside the pre-dam 100-year floodplain, the historic SO_2 smelter injury footprint of Scheffer and Hedgcock (1955[6]), and areas disturbed by human activity, and possibly natural forces such as landslides. Data that met this initial screening were evaluated further with respect to sample collection method, chemical analysis methods, and detection limits. This document expands upon EPA's LOE memorandum (USEPA 2016) and describes the DQOs for doing the agreed-upon background assessment, independent of a study to delineate the area of potential smelter deposition. The results will inform the human health and ecological baseline risk assessments by providing needed information on the range of background concentrations of metals and metalloids of soils in the uplands of the Upper Columbia River.

Data Quality Objectives

Step 1—State the Problem

The determination of background concentrations of metals and metalloids in upland soils is needed for use in the RI/FS. This task is complicated by multiple sources in the region. These include aerial deposition from smelter stack emissions (point sources) from the Teck operations at Trail, BC, and those of the LeRoi/Northport smelter in Northport, WA; geogenic sources (i.e., natural mineralization in the area that contain enrichment of some of the metals and metalloids in question); and other historical anthropogenic sources (e.g., lead arsenicals used in agriculture, combustion products of leaded gasoline).

Step 2—Identify the Goals of the Study

The goals of this task are the following:

1. To compile a dataset of background soil metals and metalloid concentrations that has adequate data quality and sample coverage to assess background beyond areas potentially impacted by Trail operations in the U.S.
2. To prepare summary statistics for background soil metals and metalloid concentrations for use in future tasks related to assessing ecological and human health risks.

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1) *Anthropogenic* – natural and human-made substances present in the environment as a result of human activities (not specifically related to the CERCLA release in question); and,

2) *Naturally occurring* – substances present in the environment in forms that have not been influenced by human activity."

[5] USEPA. 2016. EPA level of effort (LOE) for assessment and estimations of upland soils - Upper Columbia River Basin. U.S. Environmental Protection Agency, Technical Team.

[6] Scheffer, T. C., and G. G. Hedgcock. 1955. Injury to northwestern forest trees by sulfur dioxide from smelters. Technical Bulletin 1117. U.S. Department of Agriculture, Economic Research Service.

The background assessment will consider variations in metals and metalloid concentrations independent of influences from nearby historic/active mining and other human activity.

Step 3—Identify Information Inputs

The first task under this step will be to seek out existing data for samples collected in northeast Washington State, and then filter those data as discussed below in Step 6. The data sources considered will include the following general categories with the documentation of the metadata considered in the Data Compilation subsection of Step 5.

- Data from studies identified in EPA's LOE memorandum
- Studies Referenced in Other Teck/UCR Reports
- On-Line Data Repositories
  - UCR-RIFS Database
  - EIM Data from Northeastern Washington
  - National Uranium Resource Evaluation (NURE)-Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) Dataset
  - British Columbia Soil Information System (BCSIS)
  - USGS PLUTO Database
  - British Columbia Ministry of Environment (BCME)

See Attachment A for the data sources under consideration.

Step 4—Define the Boundaries of the Study

Soil samples from a broad area in northeastern Washington on either side of the Columbia River will be considered. Data from studies conducted near the Columbia River will be given preference, but soil samples from further away may be needed to verify that the closer-in data represent background and have not been influenced by the Trail or LeRoi/Northport smelters. Age of data is not a consideration as many metals (especially lead) have a long soil half-life. However, depth of soil is important as human health and baseline risk assessments consider only surface soils (0–1 in. and 0–3 in. deep, respectively). As such, surface soils are preferred; however, samples collected deeper than 6 in. will be critically reviewed and included only if significant data gaps exist.

Step 5—Define the Analytic Approach

This study has three steps:

1. Qualify the data and compile the database

2. Examine the data geospatially to verify that the samples do represent background (i.e., are not influenced by local anthropogenic sources) and determine if they can be merged into a single set of data or need to be considered in two or more distinct geographic areas

3. Calculate the 95th upper tolerance level (UTL) for each of the metals/metalloids of interest.

Data Compilation

The dataset used to determine background soil concentrations will be evaluated using a tiered approach similar to that presented in EPA's LOE memorandum[6]. The three tiers will include the following:

- Tier I Screening—Samples should conform to the following:
  - Located in northeast Washington State
  - Include geographic coordinates
  - Be a soil matrix[7] (after the proximity to drainage is assessed)
  - Be located in an undeveloped area[8]
- Tier II—Add key GIS metadata
  - Pre-dam era 100-year floodplain
  - Within or outside the historic SO_2 injury area (recording which "%Injury" zone)
  - Outside the historic SO_2 plume
  - Distance to UCR Site boundary
  - Distance to the nearest road
  - Distance to the nearest railway
  - Distance to the nearest mineralized area
  - Distance to the nearest mill
  - Distance to the nearest landfill
  - Geology
  - County
  - Drainage (plus the following)
    - Distance to the nearest drainage feature within the same drainage
    - Distance to the nearest mineralized area located upgradient in the same drainage
    - Distance to the nearest mill located upgradient in the same drainage
    - Distance to the nearest landfill located upgradient in the same drainage
    - Distance to the nearest road located upgradient in the same drainage
    - Distance to the nearest railway area located upgradient in the same drainage
    - Distance to the nearest landslide upgradient in the same drainage
  - U.S. Department of Agriculture soil type
  - Land use

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[7] In contrast to EPA's LOE memorandum (USEPA 2016), this background dataset excludes stream sediments because of possible complications related to preferential mobilization/concentration of sediment with differing mineralogies and distance from the source.

[8] For example, developed areas would include residential and commercial properties, areas near roads and railways, agricultural land, mining and mill sites, etc. This analysis would include both current and historical development.

- Tier III—Add key sampling information
  - Depth of collection
  - Sample type (e.g., grab or composite)
  - Sieve size
  - Digestion method
  - Analytical method

The supplemental metadata will be used to assess the influence of anthropogenic and geogenic sources. It also will be used to assess the matrix designations of soil and sediment. The impetus for this is that according to EPA's LOE memorandum (USEPA 2016), soil samples collected as part of the National Uranium Resource Evaluation (NURE)[9] may actually be sediment samples. To test whether the NURE data, and all other soil samples, should be classified as sediment or soil, a method will be developed to assess the location of a sample relative to the nearest drainage based on the digital elevation model for the area.

Geospatial Examination

Once all the data and their associated metadata have been tabulated and screened, soil concentrations will be used to determine natural and area background values for each of the metal and metalloid as follows. Concentrations will be plotted and a geospatial analysis conducted to determine if there are obvious differences by either geographic location (e.g., east versus west side of the Columbia River, specific drainages) or by underlying geology. If no divisions are apparent within the data, all the data will be combined into a single dataset for the statistical analysis described below. However, if a defensible reason exists to segregate the data, then additional analyses will be conducted separately on each group of data.

Upper Tolerance Limits

The distribution of chemical concentrations in background soils will be shown graphically as a cumulative distribution function and numerically characterized by the use of the 95th percentile upper tolerance limit, as recommended by EPA (USEPA 2006[10]) for either the entire dataset or geographically limited subsets, depending upon the analysis described above.

Step 6—Specify the Performance Criteria

Performance criteria in Tier I and II screening consists of the following:

- Location undeveloped
- Pre-dam era 100-year floodplain—Outside
- Distance to the nearest drainage feature—To be determined
- Distance to the nearest road—At least 50 m away
- Distance to the nearest railway—At least 50 m away

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[9] USGS. 2016. National Uranium Resource Evaluation (NURE) Hydrogeochemical and Stream Sediment Reconnaissance data. https://mrdata.usgs.gov/metadata/nurehssr.faq.html. Accessed on September 15, 2017. Last updated on December 7, 2016. U.S. Geological Survey, Denver, CO.

[10] USEPA. 2006. Guidance on systematic planning using the data quality objectives process. EPA QA/G☐4. EPA/240/B-06/001. U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC. February 2006.

- Distance to the nearest mine—At least 500 m away
- Distance to the nearest mill—At least 500 m away
- Distance to the nearest landslide—Outside footprint

Sampling and chemical analytical methods described in Tier III will be assessed according to the following:

- Analytical methods should be by ICP or AA
- Detection limits should be below risk values for human health and ecological risk assessments
- Sample type should be determined to be soil and not sediment underlying existing waterbodies
- Depth intervals of 0–1 in. and 0–3 in. preferred, but up to 6 in. may be acceptable if significant data gaps exist
- Sieve size 2 mm (No. 10) or greater

In the unlikely event that all data will be screened out by the above criteria, i.e., no acceptable samples are identified, TAI will revisit the criteria to determine which ones are the most restrictive. TAI will then propose less restrictive criteria, recognizing that the resulting background values will be less robust and subject to greater uncertainty. TAI will engage EPA in a dialogue regarding the newly proposed criteria prior to completing the analysis.

Step 7—Develop a Plan for Obtaining the Data

See Attachment A for studies under consideration. This is the totality of the data available within the specified study area and so represents the entire dataset. Analytical results of the chemical concentrations for the COPCs for these studies are already tabulated, but some may need metadata added, such as collection or analytical methods, sieve size, and depths. Some of the metadata listed in Tier II will be added following initial GIS analyses.

Metadata will be retrieved from sources such as:

- Soil type – USGS Natural Resources conservation Service; published soil surveys for Washington.
  (https://www.nrcs.usda.gov/wps/portal/nrcs/surveylist/soils/survey/state/?stateId=WA)

- Locations of roads, railroads, mills, mines, landfills, etc. are available from maps prepared for the Upland Soil Sampling Study[11].

- Land use and land ownership are available from maps prepared for the Upper Columbia River Soil Study (TAI 2015) and the residential soil studies (USEPA 2016[12]).

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[11] TAI. 2014. Upper Columbia River Final Soil Study Quality Assurance Project Plan. Prepared for TAI by Exponent and HDR in association and consultation with Parametrix, Inc. and Cardwell Consulting LLC.

[12] USEPA. 2016. UCR residential soil study field sampling and data summary report. Prepared by CH2M HILL, Portland, OR, for U.S. Environmental Protection Agency, Region 10.

- Mine and mills assessment report (USEPA 2002[13]).

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[13] USEPA. 2002. Preliminary assessments and site investigations report, upper Columbia River mines and mills, Stevens County, Washington. TDD: 01-02-0028. U.S. Environmental Protection Agency, Region 10, Superfund Technical Assessment and Response Team (START-2), Seattle, WA.

Attachment A

**Information Under
Consideration**
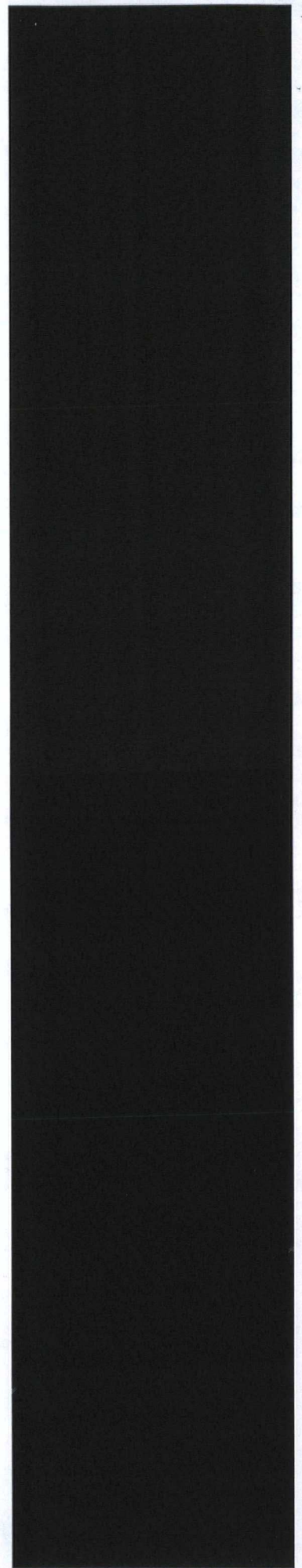
Information Under Consideration

The approach to this attachment is to list the document that presents a dataset since understanding how samples were collected and analyzed is important. The following general categories of studies are being reviewed:

- EPA's LOE memorandum (USEPA 2016)
- Studies Referenced in Other Teck/UCR Reports
- On-Line Data Repositories
  - UCR-RIFS Database
  - EIM Data from Northeastern Washington
  - National Uranium Resource Evaluation (NURE)-Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) Phase
  - British Columbia Soil Information System (BCSIS)
  - USGS PLUTO Database
  - British Columbia Ministry of Environment (BCME)

EPA LOE Memorandum

Church, S. E., F. E. Kirschner, L. M. Choate, P. J. Lamothe, J. R. Budahn, and Z. A. Brown. 2008. Determination of premining geochemical background and delineation of extent of sediment contamination in Blue Creek downstream from Midnite Mine, Stevens County, Washington. Scientific Investigations Report 2007-5268. U.S. Geological Survey, Reston, VA.

Church, S. E. 2010. Assessment of geochemical background from NURE sediment, Upper Columbia Watershed, N.E. Washington. Prepared in support of Pakootas, et al. vs. Teck Cominco Metals, Ltd. Church GeoScience Consultants, Inc.

Church, S. E. 2010. Summary report on NURE-HSSR program. Prepared for CH2M Hill. Purchase Order No. 937078. Church GeoScience Consultants, Inc.

Ecology. 1994. Natural background soil metals concentrations in Washington State. Publication No. 94-115. Washington Department of Ecology.

Hart Crowser. 2013. Upper Columbia River upland soil sampling study, Stevens County, Washington. 17800-36. Prepared for Washington State Department of Ecology. Seattle, WA.

Hart Crowser. 2013. Van Stone Mine remedial investigation. 17800-11. Prepared for Washington State Department of Ecology. Seattle, WA.

Shannon & Wilson. 2011. Soil remediation, boundary land port of entry, Stevens County, Washington. Prepared for Randolph Construction Services, Inc., Pasco, WA. Shannon & Wilson, Inc., Richland, WA.

Smith, D. B., W. F. Cannon, L. G. Woodruff, F. Solano, J. E. Kilburn, and D. L. Fey. 2013. Geochemical and mineralogical data for soils of the conterminous United States. Data Series 801. U.S. Geological Survey, Reston, VA.

USEPA. 2002. Preliminary assessments and site investigations report, lower Pend Oreille River mines and mills, Pend Oreille, Washington. U.S. Environmental Protection Agency, Region 10, Superfund Technical Assessment and Response Team (START-2), Seattle, WA.

USEPA. 2002. Preliminary assessments and site investigations report, upper Columbia River mines and mills, Stevens County, Washington. U.S. Environmental Protection Agency, Region 10, Superfund Technical Assessment and Response Team (START-2), Seattle, WA.

USEPA. 2003. Upper Columbia River expanded site inspection report, northeast Washington. U.S. Environmental Protection Agency, Region 10, Superfund Technical Assessment and Response Team (START-2), Seattle, WA.

Windward. 2015. Upper Columbia River, soil study data summary report. Prepared for Teck American Incorporated, Spokane, WA. Prepared in association and consultation with Exponent, Parametrix, and ENVIRON. Windward Environmental LLC, Seattle, WA.

Wells, K. 2015. Heavy metal contamination in soil and lichen tissue in the Colville National Forest, Washington, USA. Masters. School of Environment, Natural Resources and Geography, Bangor University, Wales, United Kingdom. 110 pp.

MESL. 2014. Determination of regional background concentrations of selected metals in sediments of the Upper Columbia River drainage basin. Prepared for Confederated Tribes of the Colville Reservation, Nespelem, Washington. MacDonald Environmental Sciences Ltd. Nanaimo, BC.

Bortleson, G.C., S.E. Cox, M.D. Munn, R.J. Schumaker, E.K. Block, L.R. Lucy, and S.B. Cornelius. 1994. Sediment quality assessment of Franklin D. Roosevelt Lake and upstream reach of the Columbia River, Washington, 1992. Open-file Report 94-315. U.S. Geological Survey, Tacoma, WA.

Johnson, A., D. Norton, and B. Yake. 1989. An assessment of metals contamination in Lake Roosevelt. Publication No. 89-e26. December 1989. Washington Department of Ecology, Toxics Invest./Ground Water Monitoring Section, Olympia, WA.

Johnson, A. 1991. Review of metals, bioassay, and macroinvertebrate data from Lake Roosevelt benthic samples collected in 1989. Washington Department of Ecology, Olympia, Washington.

Besser, J. M., W. G. Brumbaugh, C. D. Ivey, C. G. Ingersoll, and P. W. Moran. 2008. Biological and Chemical Characterization of Metal Bioavailability in Sediments from Lake Roosevelt, Columbia River, Washington, USA. Archives of Environmental Contamination and Toxicology 54(4):557-570.

CH2M HILL. 2012. Summary and evaluation of Phase 1 (2005) sediment toxicity tests Upper Columbia River site. Final. Submitted to U.S. Environmental Protection Agency, Region 10. CH2M HILL, Inc.

Schut, J. and Stefanoff, J. 2007. Upper Columbia River Site CERCLA RI/FS: Summary and evaluation of 2005 sediment toxicity test results. August 24, 2007 draft. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA.

CH2M HILL and E&E. 2006. Draft Final Phase I sediment sampling data evaluation, Upper Columbia River Site CERCLA RI/FS. Prepared for U.S. Environmental Protection Agency, Region 10. CH2M HILL and Ecology and Environment, Inc.

Hurst, D. 2004. Project Report: Analysis of sediment samples from Colville Reservation interior waters (2002-2003). Prepared for Environmental Trust Department, Confederated Tribes of the Colville Reservation. Prepared by Fulcrum Environmental Consulting. Spokane, Washington.

Studies Referenced in Other Teck/UCR Reports

All of these reports are available and the data tabulated.

Cantox. 2003. Ecological risk assessment for Teck Cominco operations at Trail, British Columbia, Terrestrial Risk Modeling Level of Refinement #2. Cantox Environmental, Inc., Calgary, Alberta, Canada. November 2003.

Golder. 2005. Teck Cominco wide area ecological risk assessment: terrestrial field and mapping methods. Preliminary draft report. Prepared for Teck Cominco Metals Ltd., Trail, BC. Golder Associates. January 2005.

Ames, K. C., and E. A. Prych. 1995. Background concentrations of metals in soils from selected regions in the State of Washington. Water-Resources Investigations Report 95-4018. U.S. Geological Survey.

Goodarzi, F., H. Sanei, P. Klassen, W. F. Duncan, and S. Hilts. 2001. Preliminary assessment of background concentrations of elements in soil from the trail area. Geological Survey of Canada (Calgary) and Teck Cominco Metals Ltd.

Goodarzi, F., H. Sanei, R. G. Garrett, and W. F. Duncan. 2002. Accumulation of trace elements on the surface soil around the Trail smelter, British Columbia, Canada. Environ Geol 43(1–2):29–38.

On-Line Data Repositories

UCR-RIFS Database

Report Not Seen

Enns, B. 2007. Trail ERA surface soil data south of border. Email to D. Nielsen, Integral Consulting Inc., Mercer Island, WA. June 11, 2007. Delphinium Holdings Inc., Castlegar, BC.

Golder. 2005. Waneta hydroelectric expansion project investigation of proposed worksites for contamination and remedial measures. Golder Associates Ltd., Burnaby, B.C. November 8.

Report Seen

Golder. 2005. Preliminary draft report on Teck Cominco wide□area ecological risk assessment: Terrestrial Field and Mapping Methods. Golder Associates Ltd., Burnaby, BC.

Holmgren, G. G. S., M. W. Meyer, R. L. Chaney, and R. B. Daniels. 1993. Cadmium, lead, zinc, copper, and nickel in agricultural soils of the United States of America. J Environ Qual 22:335–348.

Weston (Weston Solutions). 2005. Le Roi Smelter removal action report, Northport, Stevens County, WA. Prepared for U.S. Environmental Protection Agency, Region X, Seattle, WA by Weston Solutions, West Chester, PA.

Burt, R., M. A. Wilson, M. D. Mays, and C. W. Lee. 2003. Major and trace elements of selected pedons in the USA. J Environ Qual 32:2109–2121.

USDA NRCS. 2009. Soil geochemistry spatial database. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/home/?cid=nrcs142p2_053632. Accessed on August 24, 2017. U.S. Department of Agriculture, Natural Resources Conservation Service.

Wilson, M. A., R. Burt, S. J. Indorante, A. B. Jenkins, J. V. Chiaretti, M. G. Ulmer, and J. M. Scheyer. 2008. Geochemistry in the modern soil survey program. Environmental Monitoring and Assessment 139(1):151–171.

HDR. 2015. Quality assurance project plan for the Bossburg Flat Beach refined sediment and soil study. Prepared for Teck American Incorporated, Spokane, WA. HDR, Mahwah, NJ.

HDR. 2015. Quality assurance project plan for the Bossburg Flat Beach refined sediment and soil study, Amendment No. 1. Prepared for Teck American Incorporated, Spokane, WA. HDR, Mahwah, NJ.

Windward. 2016. Bossburg Flat Beach refined sediment and soil study data summary report. Prepared for Teck American Incorporated, Spokane, WA. Prepared in association and consultation with Exponent and Parametrix, Inc., Bellevue, WA. Windward LLC, Seattle, WA.

Ramboll ENVIRON. 2016. 2016 Residential soil study quality assurance project plan, Addendum No. 1 to the 2014 residential soil study quality assurance project plan. Prepared for Teck American Incorporated, Spokane, WA. Ramboll ENVIRON, Seattle, WA.

SRC. 2014. Quality assurance project plan, Upper Columbia River residential soil study, Washington State. Prepared for U.S. Environmental Protection Agency, Region 10. SRC, Inc. for Lockheed Martin. SRC, Inc., Syracuse, NY.

CH2M HILL. 2016. UCR residential soil study field sampling and data summary report. Prepared for U.S. Environmental Protection Agency, Region 10. CH2M HILL, Portland, OR.

ARCADIS. 2015. Quality assurance project plan, time critical removal action, Northport, Washington. Prepared for Teck American Incorporated. ARCADIS U.S., Inc., Seattle, WA.

USEPA. 2002. Preliminary assessments and site investigations report, lower Pend Oreille River mines and mills, Pend Oreille, Washington. U.S. Environmental Protection Agency, Region 10, Superfund Technical Assessment and Response Team (START-2), Seattle, WA.

USEPA. 2002. Preliminary assessments and site investigations report, upper Columbia River mines and mills, Stevens County, Washington. U.S. Environmental Protection Agency, Region 10, Superfund Technical Assessment and Response Team (START-2), Seattle, WA.

Carter, P. 2009. Personal communication (letter to Jim Whitbread of Stevens County Department of Public Works, dated February 3, 2009, regarding no further action at the Brooks Road, Evens, WA site (site no. 7070765)). Washington State Department of Ecology, Spokane, WA.

URS. 2008. Voluntary cleanup report, Brooks Road/Bonanza Mine roadbed materials, Stevens County, Washington. Prepared for Stevens County Department of Public Works. Spokane, WA.

Carter, P. 2009. Personal communication (letter to Jim Whitbread of Stevens County Department of Public Works, dated February 3, 2009, regarding no further action at the Peterson Swamp Road, Evens, WA site [Site No. 2704912]). Washington State Department of Ecology, Spokane, WA.

URS. 2008. Voluntary cleanup report, Peterson Swamp/Bonanza Mine roadbed materials, Stevens County, Washington. Prepared for Stevens County Department of Public Works. Spokane, WA.

Hart Crowser. 2013. Van Stone Mine remedial investigation. Prepared for Washington State Department of Ecology. 17800-11. Hart Crowser, Seattle, WA.

EIM Data from Northeastern Washington

EIM data will be filtered by evaluating an aerial photograph in which all the samples for the EIM Study ID are plotted. The study will be categorized "developed" or "further evaluation" since many studies may center around developed areas and can be filtered out.

National Uranium Resource Evaluation (NURE)-Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) Phase

USGS. 2001. Geochemistry of soils from the PLUTO database. https://mrdata.usgs.gov/pluto/soil/. Accessed on March 31, 2017. U.S. Geological Survey, Reston, VA.

British Columbia Soil Information System (BCSIS)

Three locations, 1–10 samples per station. Locations are west of Idaho western border, east of Cascade Mountains, and south of northern tip of Cascade Mountains.

USGS PLUTO Database

USGS. 2001. Geochemistry of soils from the PLUTO database. https://mrdata.usgs.gov/pluto/soil/. Accessed on March 31, 2017. U.S. Geological Survey, Reston, VA.

Description—This dataset contains geochemical data for soils collected in the United States and analyzed in the analytical laboratories of the Geologic Division of the U.S. Geological Survey (USGS). These data represent analyses of soil samples collected in support of various USGS programs. The data were originally entered into the in-house PLUTO database which was used by the Geologic Division from the mid- 1970's through the mid-1990's to archive geochemical data. A portion of the PLUTO data base is published as: Baedecker, P.A., Grossman, J.N., and Buttleman, K.P., 1998, National Geochemical Data base: PLUTO geochemical data base for the United States: U.S. Geological Survey Digital Data Series DDS-47. The data presented here are derived from DDS-47.

British Columbia Ministry of Environment (BCME)

BCME. 2010. Protocol 4 for contaminated sites. Determining background soil quality. Prepared pursuant to Section 64 of the *Environmental Management Act*. British Columbia Ministry of Environment.

BCME. 2005. Technical Guidance 16 on Contaminated Sites. Soil sampling guide for local background reference sites. British Columbia Ministry of Water, Land and Air Protection.

BCME. 2016. Technical Guidance 17 on Contaminated Sites. Soil quality database. British Columbia Ministry of Environment.